

VERIFICATION OF CALCULATIONS USING THE GRID CONVERGENCE INDEX FOR STRUCTURAL FINITE ELEMENT ANALYSES

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The Grid Convergence Index (GCI), as developed by Patrick Roache [1,2], is presented as the standard method of demonstrating mesh convergence in finite element simulations for structural dynamics.

Through use of the GCI, numerical confidence bands may be assigned to a given simulation metric (strain, stress, nodal displacement, etc.) in a statistically sound manner. However, in practical engineering simulations involving non-linear phenomena (such as contact and non-smooth loading), there are cases where the GCI breaks down.

Examples are given for cases where the GCI is appropriate, and for cases where the GCI fails. Alternative convergence criteria are proposed and discussed, as well as methods of relating alternative convergence criteria to numerical confidence bands for simulation metrics.

References

- [1] Roache, P. J., **Verification and Validation in Computational Science and Engineering**, Hermosa Publishers, Albuquerque, New Mexico, 1998.
- [2] Roache, P. J., "Verification of Codes and Calculations," *AIAA Journal*, Vol. 36, No. 5, May 1998, pp. 696-702.